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INTERNAL FLUID MECHANICS RESEARCH

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The Internal Fluid Mechanics Division is responsible for computational and experimental research on the internal aerothermodynamics of aeronautical and space propulsion systems. The research focuses on advancing the understanding of the relevant physics associated with improving the state of technology for propulsion system components. Research consists of the development of fast and accurate computational tools and models, the verification of these CFD tools and models through benchmark experiments, and their application to realistic propulsion system components. Advanced computational technologies are used to enhance, accelerate, and integrate computational and experimental research. The presentations to follow summarize ongoing work and indicate emphasis in three major research thrusts, namely, inlets, ducts, and nozzles; turbomachinery; and chemical reacting flows.

Goal

Bring internal computational fluid mechanics to a state of practical application for aerospace propulsion systems

Strategies

- **Provide state-of-the-art computational and experimental IFMD research programs.**
- **Combine advances in codes with emerging high-performance computing technologies to provide capabilities for interactive analysis and design optimization.**
- **Participate in cooperative research efforts to develop multidisciplinary analysis capabilities (e.g., NPSS).**
- **Develop closer working relationships with the propulsion industry and universities.**
- **Augment the research efforts of industry.**
- **Develop joint programs with industry.**

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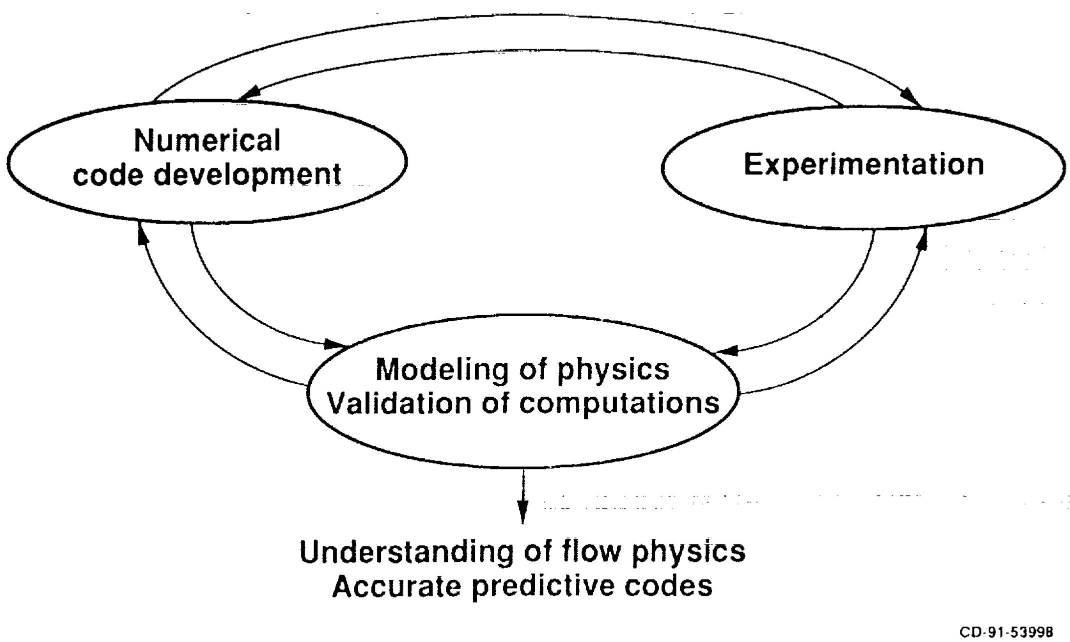
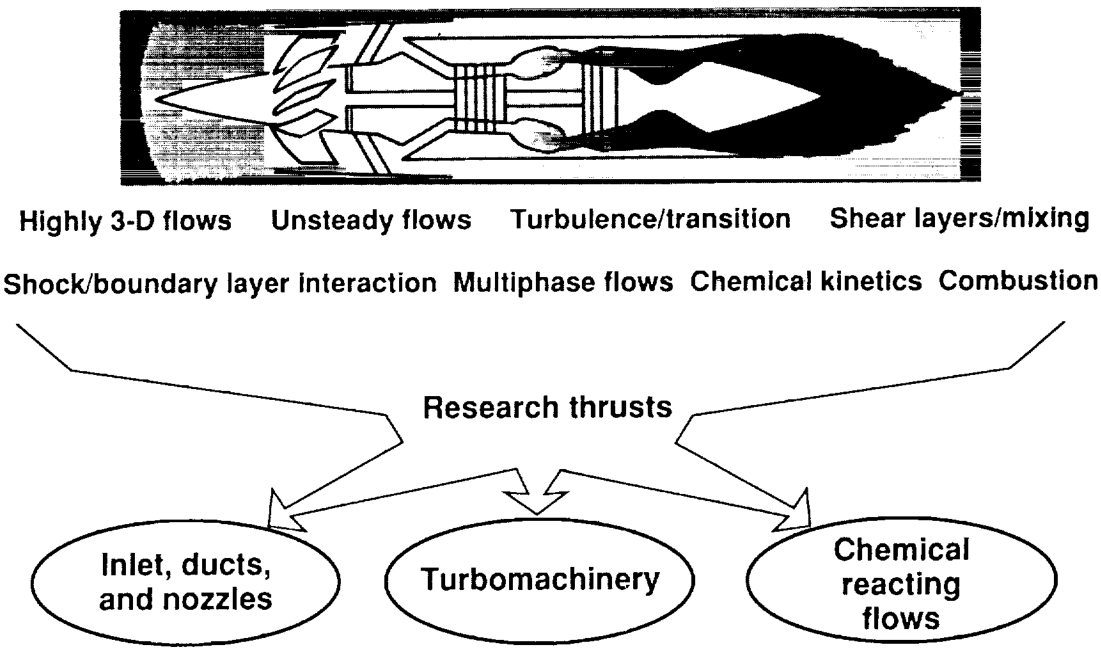
Closely Coupled Experimental and Computational Research



It is critical that numerical code development work and experimental work be closely coupled. The insights gained from experiments are represented by mathematical models that form the basis for code development. The resultant codes and models are then tested by comparing them with appropriate experiments in order to ensure their validity and determine their applicable range.

Research Thrusts



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Propulsion systems are characterized by highly complex and dynamic internal flows. Many complex, three-dimensional flow phenomena are present, including unsteadiness, shocks, and chemical reactions. By focusing on specific portions of a propulsion system, it is often possible to identify the dominant phenomena that must be understood and modeled for obtaining accurate predictive capability. In the following presentations on internal fluid mechanics research, emphasis is placed on inlets, ducts, and nozzles, on turbomachinery, and on chemical reacting flows. These three research thrusts serve as a focus leading to greater understanding of the relevant physics and to improved computational fluid dynamics tools and models. This in turn will hasten advancements in propulsion system performance and capability.